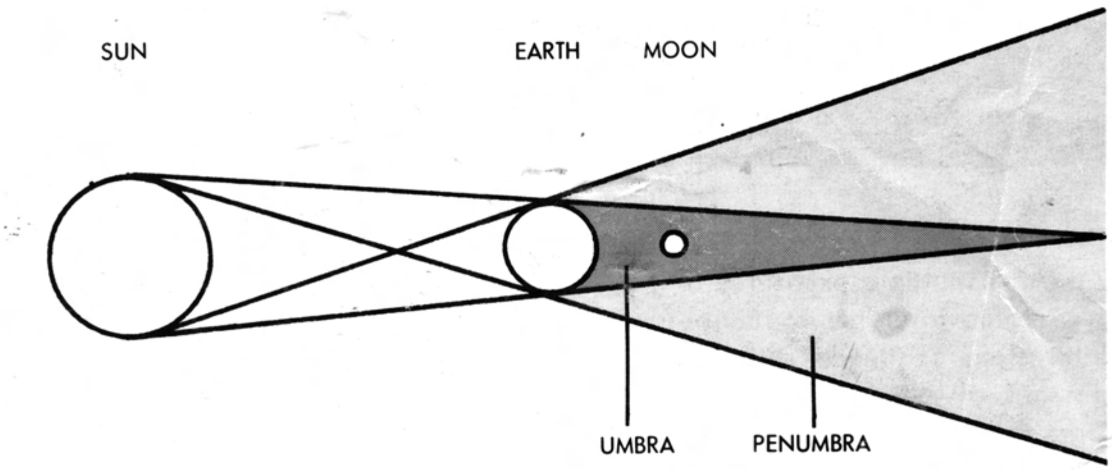
KODAK CUSTOMER SERVICE PAMPHLET 50¢

Lunar-Eclipse Photography

AM-18



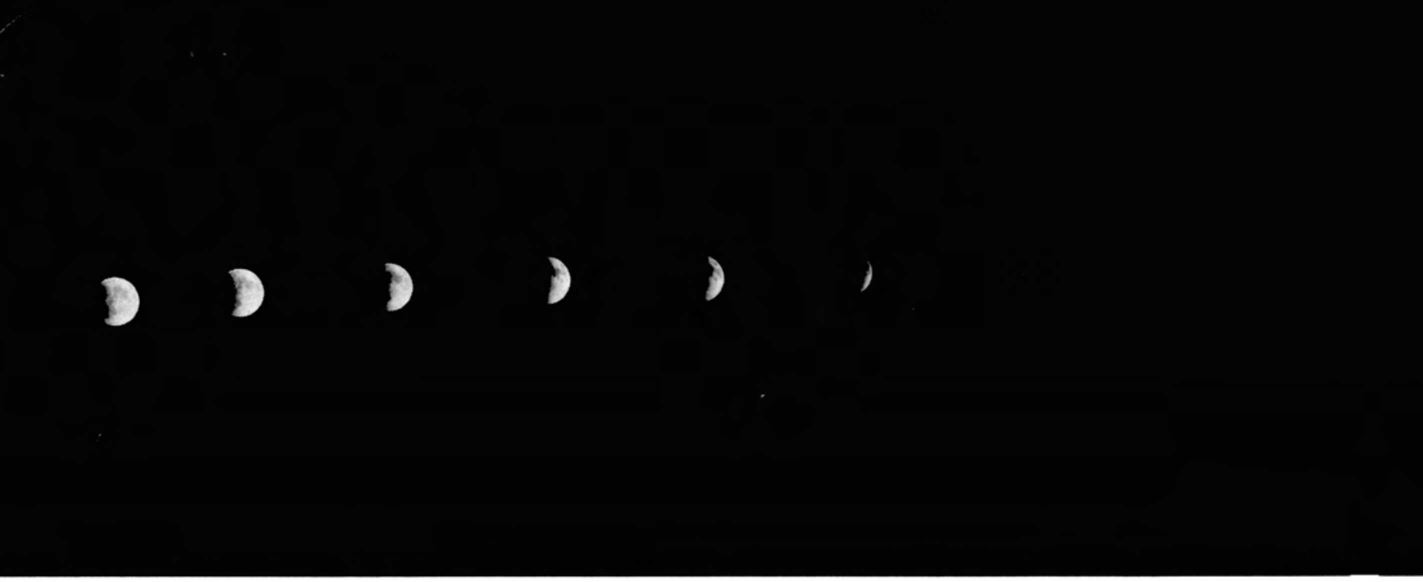
A lunar eclipse occurs when the moon passes through the shadow of the earth. When the moon is within the umbra part of the earth's shadow (see illustration above), it changes color. Its color usually varies from red to brown, although many other tints may appear. Totality, the length of time the moon is totally within the umbra, may last as long as 1 hour and 40 minutes. Before the moon moves into the umbra, it passes through an area of partial illumination, called the penumbra. In the penumbra, the moon appears slightly dimmer than when it's in the full light of the sun.

It's easy to photograph a lunar eclipse. However, because the moon is so dim during totality, you should use a high-speed film. During totality, use the largest lens opening possible. This allows you to use shorter exposure times to stop the moon's motion in your photographs.

The moon may appear large to you, but when photographed through a lens of normal focal length, it will look like a very small spot on the film. You can estimate the diameter of the moon's image that will be recorded on your film by dividing the focal length of your camera lens by 110. The same units—inches or millimeters—must be used for both the image diameter and the focal length.

Use the lens with the longest focal length available for your camera, and put the camera on a tripod to hold it steady. If you want to study detail on the moon's surface, take your pictures through a telescope, spotting scope, or binoculars. To learn how to do this, read *Astrophotography with Your Camera,* KODAK Publication No. AC-20. You can get a copy from your photo dealer, or by writing to Eastman Kodak Company, Department 841, at the address given under "More Information." For prompt delivery, please send a self-addressed business-size envelope with the publication title and number written on the back.

◀ Punched to fit the **KODAK Photographic Notebook.**
See your photo dealer.



By making multiple exposures of the moon at regular intervals, you can obtain an interesting sequence showing the progression of the eclipse all in one photograph. To try this technique, you need a camera that allows you to make multiple exposures on the same frame of film. Check your camera manual to see if you can do this with your camera. You should use a normal-focal-length lens so that you can get the whole series in one picture. Aim your camera so that the picture will include the path of the moon as it moves across the sky from east to west.

To capture the sequence, begin taking pictures as the moon moves into the umbra. Make exposures at 6-minute intervals so that the images of the eclipse will be evenly spaced across the film frame. A normal-focal-length lens will cover an angle of view sufficient for about a 2-hour series of exposures. Since the images of the moon will be quite small, you may want to have an enlargement made.

SUGGESTED EXPOSURES FOR LUNAR-ECLIPSE PHOTOGRAPHY

Lunar eclipses vary widely in duration and in apparent brightness and color. Variations in atmospheric conditions and in the distance of the moon above the horizon may affect the moon's apparent brightness, making exact recommendations impossible. Use the exposures suggested in the table on page 4 as guides only. If the sky is hazy or if the moon is low in the sky, try doubling the recommended exposure time.

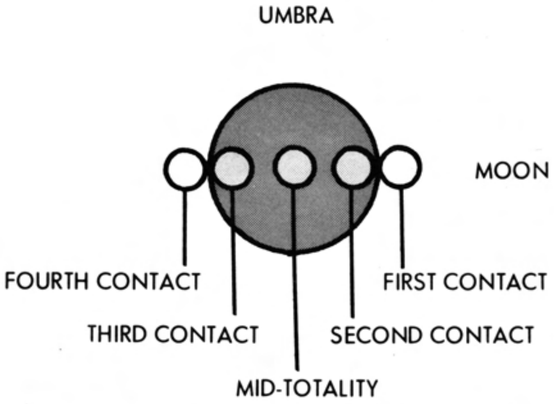
When you're taking single pictures of the moon, it's a good idea to bracket the estimated exposure for more assurance of properly exposed pictures. Take a picture at the suggested exposure; then take another picture at 1 stop less exposure, and a third picture at 1 stop more exposure. If you want even more assurance of a properly exposed picture, take two *more* pictures—one at 2 stops under and one at 2 stops over the exposure suggested in the table.

When the moon is partially in the umbra, where you can see a definite shadow line across its surface, select the exposure for either the umbra portion or the penumbra portion. The film cannot properly record both areas at the same time.

Gradually increase the exposure from the second contact to mid-totality; decrease the exposure from mid-totality to the third contact (see exposure table).

You can calculate exposure times for *f*-numbers other than those given in the table. Suppose the largest opening your lens has is *f*/5.6 and the table suggests *f*/2.8. Divide 5.6 by 2.8 and square the answer: $5.6 \div 2.8 = 2$, and $2^2 = 4$. This means the *f*/5.6 lens opening will require an exposure 4 times as long as that required with a lens opening of *f*/2.8. For example, if the table suggests 1 second at *f*/2.8, you can use 4 seconds at *f*/5.6.

The moon appears to move a distance equal to approximately half its diameter in one minute. If the exposure time with a normal-focal-length lens is longer than 10 seconds, the moon's motion is likely to be evident in the photograph. If you use a telephoto lens or a telescope with your camera, the maximum exposure time must be even shorter.



You can use the following simple formula to determine the approximate maximum exposure time for sharp pictures of the moon with a telephoto lens or telescope.

$$\frac{\text{Focal length of normal lens}}{\text{Focal length of telephoto lens (or telescope)}} \times 10 = \text{Maximum exposure time in seconds}$$

For example, suppose the normal lens for your 35mm camera has a focal length of 50mm and you want to use a telephoto lens of 400mm. Then, $\frac{50}{400} \times 10 =$ 1.25. The answer, 1.25, means that the maximum exposure time for sharp pictures of the moon with the 400mm lens is about 1 second.

SUGGESTED EXPOSURES FOR LUNAR-ECLIPSE PHOTOGRAPHY

STAGE OF ECLIPSE	FILM SPEED (ASA)						
	25	32	64	80	125	160	400
Full moon, clear sky	1/250 f/4 ↓ 5.6	1/250 f/5.6	1/250 f/8	1/250 f/8 ↓ 11	1/250 f/11	1/250 f/11 ↓ 16	1/250 f/22
Moon deep in penumbra up to FIRST contact and after FOURTH contact	1/60 f/4 ↓ 5.6	1/60 f/5.6	1/60 f/8	1/60 f/8 ↓ 11	1/60 f/11	1/60 f/11 ↓ 16	1/60 f/22
At SECOND and THIRD contacts	3 f/2	2 f/2	1 f/2	1 f/2 ↓ 2.8	1 f/2.8	1 f/2.8 ↓ 4	1/4 f/2.8
MID-TOTALITY	10 f/2	8 f/2	4 f/2	3 f/2	2 f/2	2 f/2 ↓ 2.8	1 f/2.8

Note: All exposure times are in seconds or fractions of a second. The ↓ symbol indicates the lens opening halfway between the two *f*-numbers shown.

MORE INFORMATION

If you have additional questions about lunar-eclipse photography, write to Eastman Kodak Company, Photo Information, Department 841, 343 State Street, Rochester, New York 14650.

Be sure to see the many Kodak Photo Books, including the popular "Here's How" series, on sale at photo dealers. There are eight books in the series: The first seven have a list price of 95¢ each; the eighth one is $1.25.

You can get the first six "Here's How" books all in one hard-cover edition entitled, *The Here's How Book of Photography* (AE-100), $9.95. It contains 39 articles written by Kodak's top photographic specialists, and its 394 pages are illustrated with more than 400 color photographs. The book offers an abundance of new ideas and techniques for photographing flowers, pets, tabletops, and stars, plus articles on underwater photography and slide derivations. Other subjects include photographing children, nature subjects, and candids.

Two other publications you may be particularly interested in are *KODAK Films for the Amateur* (AF-1), $1.25, and the *KODAK Master Photoguide* (AR-21), $2.50. Try your dealer first; if he can't supply the books you want, you can order by title and code number directly from Eastman Kodak Company, Department 454, Rochester, New York 14650. Please send your money order or check with the order, including your state and local sales taxes. Prices are subject to change without notice.

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